Executive Summary:

This report presents the current mechanical design of the University of Miami Interdisciplinary laboratory, then suggests and implements, via calculation, additions and alterations meant to make it more energy efficient. The building is 10 floors high and is 178,000 square feet. Separate mechanical systems serve the laboratory and vivarium section, the office section, the penthouse mechanical floor, and general technical and equipment rooms. The Laboratory System is the focus of enhancements because it is the largest system, and because of the large potential for improvement for the current air distribution and dehumidification processes.

The Laboratory System is controlled air volume (CAV). The change introduced is making it variable air volume (VAV). This is carried out by replacing the constant volume terminal units with variable volume terminal units. The maximum air flow is set at the existing CAV levels, and the minimum flow is set at minimum ventilation requirements according to ASHRAE Standard 62.1-2004. Energy consumption analysis is carried out through simulation. A Percent Load Profile is thereby derived and combined with the peak load, which is the calculated cooling load. The annual energy savings is 14,062 MMBtu, and the associated economic savings is $16,700 per year. The payback period is 4-5 years.

The existing system dehumidification uses cooling coils to dehumidify. The proposed change is to use a spray desiccant. Kathabar Systems produces equipment to spray a water/lithium chloride solution into the supply air stream, removing the moisture. Cooled solution cools the supply air as well. Peak cooling loads from this process are also combined with the Percent Load Profile, with both the CAV and VAV profiles. CAV Kathabar savings are 27,949 MMBtu and $33,300 per year with a 12-20 year payback. VAV Kathabar savings are 33,284 MMBtu and $39,600 per year with a 6-9 year payback. The big difference in payback between CAV Kathabar and VAV Kathabar occurs because the spray desiccant system makes terminal reheat unnecessary. Savings on that material are significant enough to cause that difference.

Structural and electrical studies are also carried out to ensure that the new Kathabar equipment will be adequately supported and receive the necessary power. New precast concrete joists are sized at12RB28, but the other structural elements are sufficient, and new circuits are run off an existing panel board.

Despite the longer payback, significant energy savings with the VAV/spray desiccant dehumidification enhancements cause that system to be the recommended alternative.